

A Prospective Study of Psychosocial Work Characteristics and Long Sick Leave of Japanese Male Employees in Multiple Workplaces

Masao ISHIZAKI^{1*}, Norito KAWAKAMI², Ryumon HONDA¹,
Yuichi YAMADA¹, Hideaki NAKAGAWA³, Yuko MORIKAWA³
and The Work Stress and Health Cohort Study Group

¹Social and Environmental Medicine, Kanazawa Medical University, Japan

²Department of Mental Health, Graduate School of Medicine, The University of Tokyo, Japan

³Epidemiology and Public Health, Kanazawa Medical University, Japan

Received December 12, 2012 and accepted March 12, 2013

Published online in J-STAGE May 2, 2013

Abstract: The aim of this study was to identify psychosocial work characteristics associated with long sick leave in a large population of male Japanese employees in multiple workplaces. We examined various psychosocial work characteristics (job overload, job control, supervisor support, coworker support, support by family and friends, role ambiguity, role conflict, intragroup conflict and intergroup conflict) of employees in six factories at the base line. We then conducted a follow-up survey on the recorded long sick leaves of ≥ 30 continuous days taken by the employees due to any medical condition. We found 574 cases of long sick leave out of 15,531 subjects during an average 5.07-yr follow-up. The results showed that high supervisor support was significantly associated with a decrease in the hazard ratio (HR) of long sick leave after adjustment for several confounding factors (95%CI; 0.69–0.97). High role ambiguity also tended to increase HR, but without reaching significance (95%CI; 0.99–1.41). The results suggest that supervisor support in the workplace may be important to reduce long sick leave in Japanese male employees.

Key words: Psychosocial work characteristics, Sick leave, Supervisor support

Introduction

Increased sickness absence at the workplace not only causes productivity loss, but also predicts deterioration of the general health of employees, with especially longer absences reported to be associated with ill health and mortality^{1–3}. Increased sickness absence associated with psychosocial work characteristics such as low job control,

high job strain, low support and high effort-reward imbalance has been shown in a number of investigations mainly of populations in Western Europe. Some noted that worse psychosocial work characteristics adversely affected coronary heart disease as well as psychiatric and musculoskeletal problems^{4–6}.

While some kind of relationship between psychosocial work characteristics and work-related diseases represented by cerebral-cardiac and mental disorders has been widely recognized lately in Japan^{7–9}, only a few investigations have addressed the issue of whether psychosocial work characteristics relate to long sick leave. This may be ex-

*To whom correspondence should be addressed.

E-mail: issal@kanazawa-med.ac.jp

©2013 National Institute of Occupational Safety and Health

plained by the following reasons. First, data on employees' sick leave are not necessarily accurate as Japanese workers often prefer to take sick leave in the form of paid holidays rather than official sick leave even when they are truly ill¹⁰. Second, we have no accessible official database for grasping the actual conditions of sick leave such as were available in several Scandinavian studies, for instance the data on salaries of the administrative system of the Country or Social Insurance Institution^{11, 12}.

In the meantime, the rate of absence from work in Japan is lower as compared with that in other industrial countries. The frequency of the first occurrence of sickness absence of >7 consecutive days in men working at a Japanese company amounted to about half of that of British civil servants¹³. A large-scale manufacturing company in Japan also showed a very low frequency of sick leave of ≥ 1 day per year of 2–3% for men and 1–2% for women¹⁴. Moreover, Japanese evidence reporting the influence of psychosocial work characteristics on long sick leave has been inadequate, because the designs of Japanese studies have been cross-sectional in nature¹⁵, small numbers of subjects self-reported days of sick leave^{16, 17}, and one study counted sick leave due to depressive disorders only¹⁸. Therefore, in more precisely addressing the health problems of Japanese employees as related to psychosocial work characteristics, it is important to explore any relationship between psychosocial work characteristics and recorded sick leave in a large population of Japanese.

This background prompted us to undertake the present follow-up study to identify various factors of psychosocial work characteristics relating to long-term sick leaves due to any disorders.

Subjects and Method

Nine factories employing 21,248 men and 3,745 women in total participated in the baseline study conducted from April 1996 to May 1998 regarding their psychosocial work characteristics and health status. Six of the nine factories participated in the prospective study to identify any psychosocial work characteristics predictive of ≥ 30 days of sick leave, because longer absence from work was closely associated with ill health and mortality. All the six were manufacturing factories, one light-metal, two electrical appliance, two steel product and one car part producing factories. Each factory belonged to a different large enterprise of 10,000 or more employees. At one site participants were confined to supervisors and managers. At another, only the men aged ≥ 35 yr were enrolled. Although

22,770 self-reported questionnaires were collected, we excluded 4,352 employees who had not replied to all the questions in the questionnaires. Female participants were also excluded, because they took only a small number of long sick leaves, and there was a population bias in that a single factory accounted for 80% of all 2,745 female participants and two factories had fewer than 40 female participants. In addition, we excluded 142 men, who had taken a total of ≥ 30 d of sick leave during the one year preceding the baseline survey at each factory. Ultimately we analyzed the data of 15,531 male employees for this prospective study.

This study was approved by the Research Committee for Human Subjects, Gifu University School of Medicine.

Psychosocial work characteristics

Job overload, job control, support by supervisors, coworkers, family and friends, role ambiguity, role conflict, intra-group conflict and inter-group conflict were measured by the Japanese version of the Generic Job Stress Questionnaire of the National Institute for Occupational Safety and Health (GJSQ)^{19, 20}. The number of items and Cronbach's alpha coefficient for each scale of psychosocial work characteristics were as follows: 11 items and 0.65 for job overload, 16 items and 0.95 for job control, 4 items and 0.84 for support by supervisors, 4 items and 0.80 for support by coworkers, 4 items and 0.76 for support by family and friends, 6 items and 0.80 for role ambiguity, 8 items and 0.83 for role conflict, 8 items and 0.83 for intra-group conflict, and 8 items and 0.86 for inter-group conflict, respectively.

The scores for psychosocial work characteristics were dichotomized at the median value like in other investigations^{21, 22}.

Sick leave

Thirty or more continuous days of sick leave including paid leave and medically certified disorders were recorded by the occupational doctor at each factory. Then the records were sent to be registered with the center of The Japan Work Stress and Health Cohort Study Group. The follow-up period extended to the end of March 2003. Death, resignation, and transfer to another factory were censored.

Other personal characteristics as covariates

The personal factors as covariates at baseline included age, occupational class, education, marital status, smoking habit, alcohol consumption, exercise, obesity, medication, and depressive symptom. Obesity was evaluated by body

mass index (BMI) calculated by dividing weight by height squared at health check-up, and information on other personal factors was obtained through self-administered questionnaire. All the covariates were classified as categorical data: age (≤ 35 yr, 36–45, ≥ 46), occupational class (white-collar, blue-collar), education (≤ 12 yr – high school or lower, ≥ 13 – junior college or higher), marital status (previously or never married, married), smoking habit (non-, ex-, current smoker), alcohol consumption (less than 25 g ethanol/day, 25 g and more ethanol/day), sweating exercise (less than 2 times/month – no or almost no regular exercise, 2 and more times/month – more than slight regular exercise), obesity (< 25 kg/m² – underweight or normal range, ≥ 25 – overweight or obese), medication (no medication, current medication for chronic disorder). The Japanese version of the 20-item Center of Epidemiologic Studies Depression Scale was used to assess depressive status, and the scores were categorized into two groups according to the standard cut-off score (0–15, 16–40)²³.

Statistical analysis

The SAS program package was used for the statistical analyses. To compare mean age and frequencies of the first occurrence of ≥ 30 continuous days of sick leave between the analyzed subjects and the excluded subjects, ANOVA and chi square test were used, respectively.

The hazard ratios (HR) for the first occurrence of ≥ 30 continuous days of sick leave according to each categorized age and other personal factors such as occupational class, education, marital status, smoking habit, alcohol consumption, sweating exercise, obesity, medication and depression status, were estimated using a Cox proportional hazard model. A Cox proportional model was used likewise to test the significance of psychosocial work characteristics as predictors of the first occurrence of ≥ 30 continuous days of sick leave after adjustment for the covariate factors.

Results

There were 574 cases of long sick leave recorded during the follow-up period (5.07 ± 1.41 yr). The mean and standard deviation of the baseline age and the frequencies of the first occurrence of ≥ 30 continuous days of sick leave during the follow-up period among the analyzed group (15,531 employees), the excluded group (2,869 employees who had failed to offer necessary information) and another excluded group (142 employees who had taken a total of ≥ 30 d of sick leave during the one year preceding

Table 1. Characteristics of analyzed subjects at base line

	Number of employees
Age (yr)	
–35	4,533 [29.2%]
36–45	6,223 [40.1%]
46–	4,775 [30.7%]
Occupation	
White-collar	8,997 [57.9%]
Blue-collar	6,534 [42.1%]
Education (yr)	
–12	9,705 [62.5%]
13–	5,826 [37.5%]
Marital Status	
Previously or never	3,401 [21.9%]
Married	12,130 [78.1%]
Smoking habit	
No	5,539 [35.7%]
Ex-	1,600 [10.3%]
Current	8,392 [54.0%]
Alcohol consumption (per day)	
< 25 g	7,837 [50.5%]
≥ 25	7,694 [49.5%]
Sweating exercise (per month)	
< 2 times	8,196 [52.8%]
≥ 2	7,335 [47.2%]
Obesity (BMI kg/m ²)	
< 25	12,128 [78.1%]
≥ 25	3,403 [21.9%]
Medication	
No	14,296 [92.0%]
Current	1,235 [8.0%]
Depression (CES-Dscore)	
Not depressed (< 16)	12,082 [77.8%]
Depressed (≥ 16)	3,449 [22.2%]

the baseline) were 40.4 ± 8.9 yr, 44.0 ± 9.1 yr and 44.4 ± 9.4 yr ($p < 0.01$), and 3.7%, 5.4% and 17.6% ($p < 0.01$), respectively. Both the mean age and frequencies of long sick leave in the analyzed group were lower compared with the two excluded groups.

Table 1 shows the characteristics of the analyzed subjects at the baseline. Among the three age groups, the number of employees in the group aged 36–45 years was the largest. Blue-collar workers accounted for 42.1% and 37.5% of the analyzed subjects had 13 yr or more education. 78.1% were married and 54.0% were current smokers. 49.5% consumed 25g or more alcohol per day and 47.2% had 2 times or more sweaty exercise per month. 21.9% were overweight or obese, 8.0% were currently on medication and 22.2% were depressed.

The numbers of the cases of the first occurrence of ≥ 30 continuous days of sick leave and the HRs according to

Table 2. Numbers and hazard ratios (95%CI) of the first occurrence of ≥ 30 continuous days of sick leave according to several characteristics

	Number of cases of sick leave	Hazard ratio
Age (yr)		
–35	119 [2.6%]	(–)
36–45	211 [3.4%]	1.33 (1.05–1.69)
46–	244 [5.1%]	2.27 (1.80–2.85)
Occupation		
White-collar	299 [3.3%]	(–)
Blue-collar	275 [4.2%]	1.16 (0.98–1.39)
Education (yr)		
–12	425 [4.4%]	(–)
13–	149 [2.6%]	0.70 (0.57–0.85)
Marital Status		
Previously or never	122 [3.6%]	(–)
Married	452 [3.7%]	0.78 (0.63–0.98)
Smoking habit		
No	173 [3.1%]	(–)
Ex-	43 [2.7%]	0.76 (0.55–1.07)
Current	358 [4.3%]	1.28 (1.06–1.53)
Alcohol consumption (per day)		
<25g	297 [3.8%]	(–)
≥ 25	277 [3.6%]	0.90 (0.76–1.07)
Sweating exercise (per month)		
<2 times	328 [4.0%]	(–)
≥ 2	246 [3.4%]	0.84 (0.71–0.99)
Obesity (BMI kg/m ²)		
<25	449 [3.7%]	(–)
≥ 25	125 [3.7%]	0.99 (0.81–1.20)
Medication		
No	485 [3.4%]	(–)
Current	89 [7.2%]	2.06 (1.64–2.59)
Depression (CES-Dscore)		
Not depressed (<16)	421 [3.5%]	(–)
Depressed (≥ 16)	153 [4.4%]	1.33 (1.10–1.60)

(–): reference. Data below the double line were adjusted for age.

personal characteristics as covariates are shown in Table 2. The percentages of the frequencies of long sick leave were 2.6% for the group of <36 yr of age, 3.4% for the 36–45-yr-old group and 5.1% for the >45 yr-old group. With increasing age, the HR increased. After adjustment for age, significantly higher HRs were noted in the more poorly educated subjects, those previously or never married, current smokers, those with less sweating exercise, currently medicated subjects and depressed subjects. Although the two marital statuses did not differ much in the percentages of the frequencies of long sick leave, after adjusting for age, the HR was significantly lower in the married group than in the other. This was attributed to

the fact that the younger unmarried employees took less frequent long sick leave than the older unmarried ones.

Table 3 shows the numbers and HRs of the first occurrence of ≥ 30 continuous days of sick leave as related to psychosocial work characteristics. High support by supervisors was significantly associated with decreased HR (95%CI; 0.66–0.93), and high role ambiguity was significantly associated with increased HR (1.06–1.49) after adjustment for age. On the other hand, no significant relationship was noted between sick leave and any of the other work characteristics such as job overload or job control (Model I). Even after taking into account other covariate factors, high supervisor support was significantly associated with decreased HR (0.69–0.97) (Model II; adjusted for age, occupation, education, factories and marital status, Model III; adjusted for the same factors in Model II plus smoking habit, alcohol consumption, sweating exercise and obesity, Model IV; adjusted for the same factors in Model III plus medication and depression). High role ambiguity tended to increase HR, though not significantly, in comparison with low role ambiguity (0.99–1.41).

Discussion

The HR of the first occurrence of ≥ 30 continuous days of sick leave for low supervisor support increased significantly in comparison with high supervisor support after adjustment for several confounding factors in 15,531 male employees of this follow-up study. Additionally, the ratio of the first occurrence of ≥ 30 continuous days of sick leave for high role ambiguity tended to be higher than the ratio for low role ambiguity.

As for longer recorded sick leaves in previous large scale prospective studies, low support at work predicted over 21 d of sick leave in a public utility company²¹⁾ and more than 7 d of sick leave in civil servants^{24, 25)}. Moreover, the results of prospective studies in which multiple, but not homogeneous, companies and workplaces participated, similarly showed that low support including support by supervisors at work predicted longer sick leave, over 27 d of sick leave²⁶⁾ and more than 10 d of sick leave²⁷⁾. Other studies demonstrated that some perceived role at the workplace was associated with sick leave. Low role clarity predicted a three-fold higher rate of over 3 wk of sick leave than high role clarity for white-collar men in a forest industry corporation²⁸⁾. Two follow-up studies in Denmark also noted that role conflict was associated with long sick leaves^{29, 30)}. The results of the present study were generally consistent with the findings of other such prospective

Table 3. Numbers and hazard ratios (95%CI) of the first occurrence of ≥ 30 continuous days of sick leave according to psychosocial work characteristics

psychosocial work characteristics		Number of cases of sick leave	I	II	III	IV
Job overload	low	283 (3.8%)	0.97 (0.82–1.14)	1.02 (0.86–1.20)	1.01 (0.86–1.19)	1.01 (0.85–1.19)
	high	291 (3.6%)				
Job control	low	282 (3.8%)	0.90 (0.76–1.06)	0.95 (0.80–1.13)	0.95 (0.79–1.12)	0.97 (0.81–1.15)
	high	292 (3.6%)				
Supervisor support	low	344 (4.2%)	0.78 (0.66–0.93)	0.80 (0.67–0.94)	0.79 (0.67–0.94)	0.82 (0.69–0.97)
	high	228 (3.1%)				
Coworker support	low	312 (4.0%)	0.90 (0.76–1.06)	0.90 (0.77–1.07)	0.90 (0.76–1.06)	0.93 (0.79–1.09)
	high	262 (3.4%)				
Family and friends' support	low	285 (3.8%)	1.00 (0.85–1.18)	1.03 (0.87–1.21)	1.03 (0.87–1.22)	1.05 (0.89–1.24)
	high	289 (3.6%)				
Role ambiguity	low	250 (3.3%)	1.26 (1.06–1.49)	1.23 (1.04–1.46)	1.22 (1.03–1.45)	1.18 (0.99–1.41)
	high	324 (4.1%)				
Role conflict	low	279 (3.6%)	1.04 (0.89–1.23)	1.05 (0.89–1.24)	1.04 (0.88–1.22)	1.00 (0.84–1.18)
	high	295 (3.8%)				
Intragroup conflict	low	254 (3.4%)	1.14 (0.97–1.34)	1.11 (0.94–1.31)	1.10 (0.93–1.30)	1.07 (0.90–1.27)
	high	320 (4.0%)				
Intergroup conflict	low	274 (3.3%)	1.16 (0.99–1.37)	1.15 (0.98–1.36)	1.14 (0.97–1.35)	1.10 (0.93–1.30)
	high	297 (4.0%)				

All work characteristics were dichotomized at the respective median value. Reference group was low group of each work characteristic. Model I: adjusted for age, Model II: adjusted for Model I, occupation, education, factories and marital status, Model III: adjusted for Model II, smoking habit, alcohol consumption, sweating exercise and obesity, Model IV: adjusted for Model III, medication and depression.

studies.

Support at workplaces is one of the most important factors in psychosocial work characteristics. The fact that high supervisor support was clearly associated with decreased longer sick leave in this study may partly be connected to the lifetime employment system adopted by most Japanese companies. Regular employees continue to work at the same company up to a fixed retirement age, often building up close, family-like ties with their supervisors³¹. Although the situation in the Japanese workplace has been undergoing considerable changes, this feature of Japanese companies still exists to a certain extent.

In contrast, no significant association was noted between job control and the first occurrence of ≥ 30 continuous days of sick leave in the present study, although a number of studies have reported major and consistent effects of low job control on increased sick leave^{32, 33}. The reason for the lack of a significant association between job control and long sick leave in our study remains unclear. A long sick leave sometimes may attenuate the relationship of job condition with job control. Some studies showed that low job control predicted increased relatively short sick leave, but not longer sick leave^{34, 35}. Differences in the rates of sick leave between the present study and other European

studies may have affected the result. In our study, for example, the rate of sick leave of ≥ 30 d in about 5 yr was less than 4%, while the corresponding rate in three years in the Gazel study in France was 17%³⁶.

Our former cross-sectional¹⁵ and prospective studies¹⁸ demonstrated that less job control was associated with long sick leave. However, differences in the analytic method used may have influenced the results. In the cross-sectional study, days of sick leave during the preceding one year were self-reported in the questionnaire and >6 days of total sick leave were examined. The prospective study examined the relationship between psychosocial work characteristics and long sick leave due to depressive disorders. Other disorders were not considered. In the present study we examined long sick leave taken regardless of cause.

Two other Japanese studies reported the relationship between psychosocial work characteristics and sickness absence. A two-year follow-up study showed that high job strain, measured in terms of the ratio of job demands to job control, was associated with an increased risk of ≥ 5 d sick leave¹⁶. The other cross-sectional study reported that the scores of job control and supervisor support were significantly lower in the ≥ 5 d sick leave group than the

groups taking no sick leave and 0–4.5 d sick leave in the preceding one year¹⁷). Each of these studies, however, concentrated on a single manufacturing company. For this reason, the numbers of subjects were relatively small, about 530 and 830 employees respectively, and the number of days of sick leave was not officially recorded but based on a self-reported figure. One study advised against asking subjects to recall the number of days of sick leave taken more than 2 months before³⁷). Therefore, we should keep in mind that quantitative use of self-reported sick leave unavoidably entails some degree of inaccuracy.

The present study has some potential limitations. First, during the follow-up period of about 5 yr the risk of misclassification could have been increased, thus leading to an underestimation or an overestimation of the association between psychosocial work characteristics and long sick leave. However, our follow-up period is not so long as compared with other 6 yr or 11 yr follow-up studies that reported an association between psychosocial work characteristics and increased sickness absence²¹) or heart disease³⁸). Second, individual physical load at work and changing financial circumstances during the follow-up period, which can be confounding factors affecting sick leave^{39, 40}), were not examined. But none of the firms in the study experienced major restructuring such as downsizing, solicitation of voluntary retirement, or amalgamation. Third, private injuries and diseases unrelated to work were probably included when counting the number of days of sick leave. Psychosocial work characteristics may indirectly affect private injuries and diseases mediated by factors such as social and health behaviors and influences on the immune system⁷). However, clarification of this relationship was beyond the scope of the present study.

Notwithstanding the potential factors attenuating the association between psychosocial work characteristics and sick leave, the present results suggest that improving supervisor support in the workplaces is essential for Japanese male employees to reduce the frequency of longer sick leave. This is especially important at present given the deteriorating economic climate in Japan and many other industrialized countries as well as the dramatically changing work environment due to background factors such as increasingly bitter worldwide competition entailed by globalization, rapidly increasing number of temporary workers, and more frequent employment of senior citizens. Hence, by continuing our investigations, we hope to obtain information that will be of use in promoting the health of workers.

Acknowledgements

The Japan Work Stress and Health Cohort Study Group is composed of Masao Ishizaki, Norito Kawakami, Takashi Haratani (National Institute of Industrial Health), Fumio Kobayashi (Aichi Medical University), Takeshi Hayashi (Hitachi Health Care Center), Osamu Fujita (Kariya Toyota General Hospital), Yoshiharu Aizawa (Kitasato University School of Medicine), Shogo Miyazaki (Meiji University Law School), Hisanori Hiro (University of Occupational and Environmental Health), Takeshi Masumoto (Kimitsu Health Service Center), Shuji Hashimoto (Fujita Health University School of Medicine), and Shunichi Araki (Saitama Occupational Health Promotion Center)

References

- 1) Marmot M, Feeney A, Shipley M, North F, Syme SL (1995) Sickness absence as a measure of health status and functioning: from the UK Whitehall II study. *J Epidemiol Community Health* **49**, 124–30.
- 2) Kivimäki M, Head J, Ferrie JE, Shipley MJ, Vahtera J, Marmot MG (2003) Sickness absence as a global measure of health: evidence from mortality in the Whitehall II prospective cohort study. *BMJ* **327**, 364–8.
- 3) Vahtera J, Pentti J, Kivimäki M (2004) Sickness absence as a predictor of mortality among male and female employees. *J Epidemiol Community Health* **58**, 321–6.
- 4) Marmot M, Siegrist J, Theorell T (1999) Health and the psychosocial environment at work. In: *Social determinants of health*, Marmot M, Wilkinson RG (Eds.), 97–130, Oxford University Press, Oxford.
- 5) Bonde JP (2008) Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occup Environ Med* **65**, 438–45.
- 6) da Costa BR, Vieira ER (2010) Risk factors for work-related musculoskeletal disorders: a systematic review of recent longitudinal studies. *Am J Ind Med* **53**, 285–323.
- 7) Kawakami N, Haratani T (1999) Epidemiology of job stress and health in Japan: review of current evidence and future direction. *Ind Health* **37**, 174–86.
- 8) Japan Ministry of Health, Labour and Welfare (2003) The 10th Industrial accident prevention plan. Tokyo (in Japanese).
- 9) Japan Ministry of Health, Labour and Welfare (2008) The 11th Industrial accident prevention plan. Tokyo (in Japanese).
- 10) Ogura K, Suzuki H, Fujimoto T, Ota H, Wada H (1998) Surveillance study on sick leave system. Investigation research report No.105, The Japan Institute of Labour, Tokyo (in Japanese).
- 11) Munch-Hansen T, Wieclaw J, Agerbo E, Westergaard-Nielsen N, Bonde JP (2008) Global measure of satisfaction

- with psychosocial work conditions versus measures of specific aspects of psychosocial work conditions in explaining sickness absence. *BMC Public Health* **8**, 270–7.
- 12) Suominen S, Vahtera J, Korkeila K, Helenius H, Kivimäki M, Koskenvuo M (2007) Job strain, life events, and sickness absence: a longitudinal cohort study in a random population sample. *J Occup Environ Med* **49**, 990–6.
 - 13) Morikawa Y, Martikainen P, Head J, Marmot M, Ishizaki M, Nakagawa H (2004) A comparison of socio-economic differences in long-term sickness absence in a Japanese cohort and a British cohort of employed men. *Eur J Public Health* **14**, 413–6.
 - 14) Kobayashi Y, Kaneyoshi A, Yokota A, Kawakami N (2008) Effects of a worker participatory program for improving work environments on job stressors and mental health among workers: a controlled trial. *J Occup Health* **50**, 455–70.
 - 15) Ishizaki M, Kawakami N, Honda R, Nakagawa H, Morikawa Y, Yamada Y, The Japan Work Stress and Health Cohort Study Group (2006) Psychosocial work characteristics and sickness absence in Japanese employees. *Int Arch Occup Environ Health* **79**, 640–6.
 - 16) Kondo K, Kobayashi Y, Hirokawa K, Tsutsumi A, Kobayashi F, Haratani T, Araki S, Kawakami N (2006) Job strain and sick leave among Japanese employees: a longitudinal study. *Int Arch Occup Environ Health* **79**, 213–9.
 - 17) Otsuka Y, Takahashi M, Nakata A, Haratani T, Kaida K, Fukasawa K, Hanada T, Ito A (2007) Sickness absence in relation to psychosocial work factors among daytime workers in an electric equipment manufacturing company. *Ind Health* **45**, 224–31.
 - 18) Inoue A, Kawakami N, Haratani T, Kobayashi F, Ishizaki M, Hayashi T, Fujita O, Aizawa Y, Miyazaki S, Hiro H, Masumoto T, Hashimoto S, Araki S (2010) Job stressors and long-term sick leave due to depressive disorders among Japanese male employees: findings from the Japan work stress and health cohort study. *J Epidemiol Community Health* **64**, 229–35.
 - 19) Haratani T, Kawakami N, Araki S (1993) Reliability and validity of the Japanese version of NIOSH generic job stress questionnaire. *Jpn J Ind Health* **35** (Suppl), S214 (in Japanese).
 - 20) Haratani T, Kawakami N, Araki S, Hurrell JJ Jr, Sauter SL, Swanson NG (1996) Psychometric properties and stability of the Japanese version of the NIOSH job stress questionnaire. 25th International Congress on Occupational Health, Book of Abstract, Part 2, 393.
 - 21) Melchior M, Niedhammer I, Berkman LF, Goldberg M (2003) Do psychosocial work factors and social relations exert independent effects on sickness absence? A six year prospective study of the GAZEL cohort. *J Epidemiol Community Health* **57**, 285–93.
 - 22) Ishizaki M, Nakagawa H, Morikawa Y, Honda R, Yamada Y, Kawakami N, Japan Work Stress and Health Cohort Study Group (2008) Influence of job strain on changes in body mass index and waist circumference—6-year longitudinal study. *Scand J Work Environ Health* **34**, 288–96.
 - 23) Shima S, Shikano T, Kitamura T, Asai M (1985) New self-rating scales for depression. *Clin Psychiatry* **27**, 717–23 (in Japanese).
 - 24) North FM, Syme SL, Feeney A, Shipley M, Marmot M (1996) Psychosocial work environment and sickness absence among British civil servants: the Whitehall II study. *Am J Public Health* **86**, 332–40.
 - 25) Head J, Kivimäki M, Martikainen P, Vahtera J, Ferrie JE, Marmot MG (2006) Influence of change in psychosocial work characteristics on sickness absence: the Whitehall II study. *J Epidemiol Community Health* **60**, 55–61.
 - 26) Moreau M, Valente F, Mak R, Pelfrene E, de Smet P, De Backer G, Kornitzer M (2004) Occupational stress and incidence of sick leave in the Belgian workforce: the Belstress study. *J Epidemiol Community Health* **58**, 507–16.
 - 27) Nielsen ML, Rugulies R, Christensen KB, Smith-Hansen L, Kristensen TS (2006) Psychosocial work environment predictors of short and long spells of registered sickness absence during a 2-year follow up. *J Occup Environ Med* **48**, 591–8.
 - 28) Väänänen A, Kalimo R, Toppinen-Tanner S, Mutanen P, Peiró JM, Kivimäki M, Vahtera J (2004) Role clarity, fairness, and organizational climate as predictors of sickness absence: a prospective study in the private sector. *Scand J Public Health* **32**, 426–34.
 - 29) Lund T, Labriola M, Christensen KB, Bültmann U, Villadsen E, Burr H (2005) Psychosocial work environment exposures as risk factors for long-term sickness absence among Danish employees: results from DWECS/DREAM. *J Occup Environ Med* **47**, 1141–7.
 - 30) Rugulies R, Aust B, Pejtersen JH (2010) Do psychosocial work environment factors measured with scales from the Copenhagen Psychosocial Questionnaire predict register-based sickness absence of 3 weeks or more in Denmark? *Scand J Public Health* **38** (Suppl), 42–50.
 - 31) Varieties in work and labour (1997) In: An introduction to Japanese society, Sugimoto Y (Ed.) 79–106, Cambridge University Press, Cambridge.
 - 32) Allebeck P, Mastekaasa A (2004) Swedish Council on Technology Assessment in Health Care (SBU). Chapter 5. Risk factors for sick leave – general studies. *Scand J Public Health Suppl* **63**, 49–108.
 - 33) Duijts SF, Kant I, Swaen GM, van den Brandt PA, Zeegers MP (2007) A meta-analysis of observational studies identifies predictors of sickness absence. *J Clin Epidemiol* **60**, 1105–15.
 - 34) Godin I, Kittel F (2004) Differential economic stability and psychosocial stress at work: associations with psychosomatic complaints and absenteeism. *Soc Sci Med* **58**, 1543–53.
 - 35) Alavinia SM, van den Berg TI, van Duivenbooden C,

- Elders LA, Burdorf A (2009) Impact of work-related factors, lifestyle, and work ability on sickness absence among Dutch construction workers. *Scand J Work Environ Health* **35**, 325–33.
- 36) Vahtera J, Westerlund H, Ferrie JE, Head J, Melchior M, Singh-Manoux A, Zins M, Goldberg M, Alexanderson K, Kivimäki M (2010) All-cause and diagnosis-specific sickness absence as a predictor of sustained suboptimal health: a 14-year follow-up in the GAZEL cohort. *J Epidemiol Community Health* **64**, 311–7.
- 37) Severens JL, Mulder J, Laheij RJ, Verbeek AL (2000) Precision and accuracy in measuring absence from work as a basis for calculating productivity costs in The Netherlands. *Soc Sci Med* **51**, 243–9.
- 38) Kuper H, Marmot M (2003) Job strain, job demands, decision latitude, and risk of coronary heart disease within the Whitehall II study. *J Epidemiol Community Health* **57**, 147–53.
- 39) Lund T, Labriola M, Christensen KB, Bültmann U, Villadsen E (2006) Physical work environment risk factors for long term sickness absence: prospective findings among a cohort of 5357 employees in Denmark. *BMJ* **332**, 449–52.
- 40) Vahtera J, Kivimäki M, Pentti J, Linna A, Virtanen M, Virtanen P, Ferrie JE (2004) Organisational downsizing, sickness absence, and mortality: 10-town prospective cohort study. *BMJ* **328**, 555–9.